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Econometric Analysis of the Effect of Climate Change on Crop Insurance in Oyo State, Nigeria

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ABSTRACT

Agriculture dominate most of the economic development policy in many developing countries but it is surprising that as high as the proportion of the policy to boost agricultural productivity, the countries are still suffering from food insecurity due to the countries' failure of the policy to deliver the sustained supplies of food and industrial raw materials as intended. In Nigeria, crop farmers cannot withstand the increased risks associated with climate change by adopting autonomous adaptation technique that is why Agricultural insurance is seen as one of the best strategies to address farm risks and encourage the affected farmers to get back to business and achieve better and quality yields. The framework consisted of various models ranging from climate change projection, crop yield and yield variance estimation and crop insurance payout estimation. Two categories of respondents were surveyed to obtain the data required for the analysis. A sample of 120 insured and 120 uninsured farmers were randomly selected and interviewed using structured questionnaires. The insured farmers were randomly selected from the insurance policy register while the uninsured farmers were selected from the OYSADEP farmer's register. Changes in climate affects crop yield levels and variability, rainfall and temperature increases are found to increase yield level and variability. On the other hand, rainfall and temperature are individually found to have negative effects on some yield levels and variability. The increase in yield was derived from a significant reduction in rainfall; on the other hand, the decrease in yield was caused by heat stress and the shortening of the growth period induced by the temperature rise. The results also identified that the insured farmers are less productive than the uninsured farmers in term of crop production. The R^2 indicated the proportion of the variation in output of both insured and uninsured farmers. An R2 value of 93.52% was obtained for the specify function of the insured farmer as compare to 84.38% of the uninsured farmer and 90.66% R^2 was obtained for the pooled result of the two groups of farmers. The adjusted R^2 value was obtained allow us to compare the R^2 value of the different result obtained from each group of farmers. This implies that uninsured farmers are more productive than the insured farmers in the study area and the level of production achieved did not justify any difference of production practices between the insured and the uninsured farmers without evidence of significant changes in the insurance payout method embrace by the insurance company since the obvious incidence of climate change

Keywords- climate change projection; cropyield; variance estimation; crop insurance

1. INTRODUCTION

Most Nigerian Cities are facing major stresses on water availability and extremity. The rainfall trends of the continent through the 20th century drying up to 2.5% per decade or more in some Western and Eastern parts of the Sahel

(Hulme et al; 2001). This reduced mean rainfall is expected to persist as a result of climate change. In recent years, the pattern of rainfall has tended towards the extremes, with increasing severity and frequency of drought and floods. Many countries, including Botswana, Burkina Faso, Chad, Ethiopia, Kenya Mauritania Mozambique and Nigeria experiences drought at mean rainfall over the most of the continent. The East African flood of 1988, the Mozambique floods of 2000 and the recent floods in West Africa (Ghana, Benin, Togo and Burkina Faso) in 2007 and recently the devastating floods in Nigeria 2011, which occurs in the Western parts of the country led to loss of much farmland, damage to transport networks, diseases outbreak and loss of human life. The continent already experiences a major deficit in food and animal production in many areas and potential further declines in soil moistures or inundation of crop lands has been an added burden.

Adaptation can be both autonomous and planned. Autonomous adaptation is the ongoing implementation of existing knowledge and technology in response to the changes in climate experienced; and planned adaptation is the increase in adaptive capacity by mobilizing institutions and policies to establish or strengthen conditions that are favorable to effective adaptation and investment in new technologies and infrastructure. Autonomous adaptation options can be, for example utilizing water management to prevent water logging, erosion and nutrient leaching in areas where there is an increase in rainfall; altering the timing or location of cropping activities; diversifying income by integrating into farming activities additional activities such as livestock raising; and using seasonal climate forecasting to reduce production risk. However, while many of these measures are effective against a degree of climatic variability, they may become insufficient in the face of accelerating climate change, therefore a longer-term planned approach for adaptation is therefore needed to secure sustainable livelihoods of farmers.

One of the most effective ways to address this form of agricultural risk has been the use of agricultural insurance. The need for a specialized Agricultural insurance company to provide insurance cover to farmers was informed by Government’s concern over the vacuum created due to the unwillingness of conventional Insurers to accept Agricultural risks, which they considered too risky. In Nigeria, the implementation of the scheme was thus initially vested in the Nigerian Agricultural Insurance Company limited, which later turned into a Corporation in 1993 by the enabling decree No. 37 of 1993, which was planned by the government to boost agricultural production, but it is constrained by the inability of the average farmer to provide the necessary required rules to purchase an insurance cover.

2. METHODOLOGY

The topography of the state is gentle rolling low land in the south, rising to a plateau of about 40 meters. The state is well drained with rivers flowing from the upland in the North-south direction. Oyo state has an equatorial climate with dry and wet seasons and relatively high humidity. Average daily temperature ranges between $25°\text{C}$ ($77.0°\text{F}$) and $35.0°\text{C}$ ($95.0°\text{F}$) almost throughout the year. The vegetation pattern of Oyo state is that of rain forest in the south and guinea savannah in the North.

Oyo state is one of the seriously affected state like Kogi, Niger and Anambra state in the year 2011 by the variability in climatic conditions (especially irregular weather conditions) with excessive rainfall which led to flooding as well as wind storm in the year that led to loss of human life, properties, crops, livestock etc which has not been given adequate attention (Tribune ;August 10 2011). Agricultural activities follow the traditional system of mixed cropping. This condition made the state to be agrarian suited for the production of permanent crops. Farmers are predominant small scale that still depends on traditional method of farming. Besides farming, the inhabitants also engage in other occupations like trading, manufacturing and commerce. The climate in the area favours the cultivation of crops like maize, yam, cassava, millet, rice, plantain, cacao tree, cowpea, mango, palm tree, cashew and so on

Both primary and secondary data were used for this study. The primary data include socio-economic characteristics of both insured and uninsured farmers' their production and insurance information. This information was obtained through interview schedule and administration of a structured questionnaire. The secondary data cover Climate related data such as rainfall and temperature as well as state-level data on food crop production in Oyo state from 1990- 2010. Data on climate variables were be obtained from Nigerian Meteorological Station while food production data were be obtained from Oyo State Agricultural Development Programme (OYSADEP)

To achieve the broad objectives of the study, two broad categories of respondents were surveyed to obtain the data required for the analysis. A sample of 120 insured and 120 uninsured farmers were randomly selected and interviewed using structured questionnaires. While the insured farmers were randomly selected from the insurance policy register, the uninsured farmers were selected from the OYSADEP farmer's register.

The Just-Pope production function was estimated from panel data relating yield to exogenous variables. This procedure estimates the impacts of the exogenous variables on yield levels and the variance of yield. An assumption of the model is that included variables are stationary. Deterministic and stochastic trends in variables introduce spurious correlations between the variables, because the errors in the data-generating-processes for different series might not be independent (Granger and Newbold). In other words, correlations might be detected between variables that are increasing for different reasons and in increments that are uncorrelated (Banerjee, et al, p.71. 1990). The solution to these problems is to first test for stationarity. Non-stationary variables can be differenced once and retested. If the differenced versions are stationary, the variables are said to be integrated order one or I(1). Stationary time series are integrated order zero or I(0). Regressions on stationary variables may satisfy ideal conditions, and inferences on a deterministic time trend can be made safely. There are several versions of these so-called panel unit root tests due to Im, Pesaran, M.H and Shin, Y. (2003). These tests for stationarity will be applied to each variable taking the whole panel at once. Following Just and Pope (1978). This study estimate production functions of the form:

$$Y = f(X,\beta) + h(X,\alpha)\varepsilon$$

Where Y is crop yield (cowpea, sorghum, cassava, maize, cocoyam, okro, pepper, cassava, vegetable, melon and yam), *f()* is an average production function, and X is a set of independent explanatory variables (climate, location, and time period). The functional form h() for the error term ui, is an explicit form for heteroskedastic errors, allowing estimation of variance effects. Estimates of the parameters of f() give the average effect of the independent variables on yield, while h() gives the effect of each independent variable on the variance of yield. The interpretation of the signs on the parameters of h() are straightforward. If the marginal effect on yield variance of any independent variable is positive, then increases in that variable increase the standard deviation of yield, while a negative sign implies increases in that variable reduces yield variance.

the basic model is thus specified as:

$$y_{it} = \exp(\alpha_0 + \sum_{k=1}^{k} \alpha_k x_{kit}) + \varepsilon_{it}\sqrt{\beta_0 + \sum_{m=1}^{m} \beta_m x_{mit}}$$

Where y_{it} is the crop output in region i at time t; x_{kit} is the input quantity of factor k in region i at time t, and $\alpha_j, j = 0,1........k$,, are the parameters to be estimated. x_{mit} denotes a factor which can influence the risk level and β_m is the corresponding coefficient. ε in turn is a stochastic disturbance term following the standard normal distribution. Thus, we find that the expected output (often also referred to as mean output) and the variance of output are determined by separate functions, which can algebraically be denoted as

$$E(y_{it}) = \exp(\alpha_0 + \sum_{k=1}^{k} \alpha_k x_{kit})$$ and

$$V(y_{it}) = \beta_0 + \sum_{m=1}^{m} \beta_m x_{mit}$$ respectively.

Given the assumption that production risk in this framework takes the form of heteroskedasticity in the production function, the second term on the right-hand side of equation (2) can be interpreted as a heteroskedastic error term for the purpose of estimation.

The model was estimated for each of the major staple crops in Nigeria. As the production function is specified in a log-linear way, the coefficient estimates for on this stage will be elasticities of output with respect to the respective input factors. Usually, production risks in terms of heteroskedasticity error structure are present in most parts of agricultural production (Just and Pope, 1979). In essence, a fixed effects estimator would be used to account for large and heterogeneous geographical entities within Nigerian states. If additionally a first-order autoregressive process is present in the error terms, this will cause further inefficiency with respect to the estimates of an FE regression (Wooldridge, 2002). In order to remedy both issues, a feasible generalized lest squares estimator (FGLS) was employed (Wooldridge, 2002).

Determination of Crop Insurance Decision Using Probit Model:

Probit was use to test the decision of farmers on whether to purchase crop insurance or not .Farmer's decisions to purchase crop insurance and their choices among alternative products will be analyzed using a two-stage estimation procedure. The typical framework employed to evaluate crop insurance decisions utilizes the standard assumption that farmers maximize expected utility of end-of-period wealth by choosing production factors, including crop insurance, subject to physical and technical constraints (Baquet; et al.)

The probit model assumes that there exists an underlying relationship one decision and the others

The latent equation given by $y_j^* = x_j\beta + u_{1j}$

(1)

Such that we observe only the binary outcome given by the probit model as:

$$y_j^{probit} = \left(y_j^* > 0\right)$$

The dependent variable is observed only if the observation j is observed if the selection equation:

$$y_j^{select} = \left(z_j\delta + u_{2j} > 0\right)$$

(2) $u_1 \sim N\left(0,1\right)$

$$u_2 \sim N\left(0,1\right)$$

$$corr\left(u_{1,}u_2\right) = \rho$$

Where, x is a k- vector of regressors, z is an m vector of regressors; u_1 and u_2 are error terms.

When $\rho \neq 0$, standard probit techniques applied to equation (1) which may yield biased results. Thus, the Heckman probit (heckprob) provides consistent, asymptotically efficient estimates for all parameters in such models (StataCorp, 2010). Thus, the Heckman probit selection model was employed to determine the decision of farmers for crop insurance in oyo state.

Econometric analysis with cross-sectional data is usually associated with problems of

Heteroskedasticity and Multicollinearity among explanatory variables lead to imprecise parameter estimates.

To explore potential multicollinearity among the explanatory variables, the Variance Inflation Factor (VIF) for each of the explanatory variables was calculated. The VIFs ranges from 1.07 to 1.53 which does not reach convectional thresholds of 10 or higher used in regression diagnosis. In this analysis, multicollinearity does not appear to be a problem. To address the possibilities of heteroskedasticity in the model, an estimate of a robust model that computes a robust variance estimate or based on a variable list of equation-level scores and a covariance was done.

Model of production practices by insured and uninsured farmers:

To assess the operation of Nigerian Agricultural Insurance corporation this study use econometric analysis as a basis to compare production practices between insured and uninsured farmers in the study area. Production functions project a physical relationship between inputs or factors of production and the resulting farm output represented as the dependent variable. A typical production function can be implicitly represented as $Q = f(X)$ where Q is the homogeneous output representing the endogenous variable and X, then-dimensional vector of homogeneous inputs represented as explanatory variables. For this study different functional forms were tested on the cross-sectional data collected, but the **Cobb-Douglas** function was chosen as the basis of result presentation because it enjoys a wider application in this type of study and because of the added information implied by its parameter estimates. It has been emphasized that linear and quadratic functions which were commonly used as alternatives are better suited to the analysis of experimental data than to the analysis of cross-sectional data

The statistical estimates obtained were used to compare production performance between the identified groups of respondents. The function is thus used to examine production performance and resource productivity between insured and uninsured farmers.

The Cobb-Douglas function can be implicitly presented as:

$$Q = AX^{b} X^{(1-b)}$$

Where **A** is a positive constant term and *b* a positive fraction. **Q** and **X** are the variables, the relationship between which are examined by the equation. However, in order to specify the equation, the above implicit equation must be explicitly expressed by taking the log transformation of both sides as shown below;

$$\ln Q = \beta_0 + \beta_1 \ln X1 + \beta_2 \ln X2 + ...\beta_9 \ln X9 + \mu$$

where the respective variables in the equation are represented as follows:

Q is the dependent variable is the value of the farm output; value of planting seeds, ***X1*** and capital borrowed or used (***X2***), fertilizer ***(X3)*** and farm size ***(X4)*** and value of labour employed on the farm ***(X5)****.* Other variables include expenditure on agro-chemicals such as herbicides and pesticides ***(X6)****,* expenditure on value added ***(X7)****,* value of farm assets ***(X8)*** and ***(X9)****,* a dummy variable used to represent the holding of an insurance policy. β_0, β_1 ...β_9, are the parameters (coefficients) to be estimated, that respectively measured the relationship between the inputs and output in the production process, for the ninth inputs. μ is the error term which is assumed to be normally distributed with mean zero and constant variance. ***ln*** is the natural logarithm of the respective variables included in the equation. The essence of the log transformation is in recognition of the existence of error in the included variables, by the transformation the error is made to be nearly and normally distributed without any pattern in its relationship

Model for insurance payout estimation:

A simple insurance scheme (Ray 1967; Hazell et al. 1986; Abbaspour 1994) was used to simulate the insurance payout in the state. The insurance payout in the *i*th state in *j*th year, is as follows:

$$Payout_{i,j} = \nabla Y_{i,j} \times Area_{i,j} \times P\_crop$$

Payout *i*, *j*, is given by the functions of the insured yield loss, $\nabla Y_{i,j}$ insured acreage of crop $Area_{i,j}$ and price of crop, P crop,

The crop insurance program provided by the Japanese government is designed with the assumption that all farmers must participate. An objective of the program is to establish full participation by farmers (Yamauchi 1986). With this consideration, i used the total planted acreage as the insured acreage . On the other hand, the insured yield loss, *Yi, j*, is given by

$$\boldsymbol{\nabla} Y_{i,j} = \boldsymbol{\phi}\bar{Y}i - Y_{i,j} \text{ if } Y_{i,j} < \boldsymbol{\phi}\bar{Y}i$$

$\boldsymbol{\nabla} Y_{i,j}$=0, if $Y_{i,j} \geq \boldsymbol{\phi}\bar{Y}i$, Area= production / yield

Where $Y_{i,j}$ is the yield in a given year, $\bar{Y}i$ is the standard yield, and $\boldsymbol{\phi}$ is the insurance coverage.

3. RESULTS AND DISCUSSION

From the result in table 1, the significant sign on temperature is negative for three crops (cassava, cowpea and sorghum), this indicates that this crop yield increases with more rainfall. Yam and tomato has a positive significant for temperature which implies more yield with more temperature. For rainfall, the results shows that cocoyam, cowpea, melon, Okro, pepper and tomatoes has a high positive response to rainfall which means with more rainfall, the yield of these crops will increases. It is also observed that that crops have a positive response with time trend, which indicates that if the amount of rainfall supply increases with time, there is tendency for increase in yield of the specified crops in the region.

Table 1: Estimated Parameter for average crop yield production (f(X,) under linear function

Crop	Temperature	Rainfall	Year	Constant
Cassava	-0.7102* (-0.1674)	0.40433 (0.5225)	0.34459 (-1.043)	9.8511 (0.7120)
Cocoyam	0.33951 (1.578)	0.8122* (3.242)	0.13226* (3.250)	-9.4102 (-1.310)
Cowpea	-0.2760 (-1.040)	0.1909* (2.312)	0.1962* (4.053)	1.1226 (7.169)
Maize	0.13529 (1.256)	0.32788* (4.265)	0.12455** (1.840)	-3.2360 (-0.9340)
Melon	0.8935 (1.113)	0.1472** (1.852)	0.2313* (2.951)	3.0453 (0.5467)
Okro	0.50283 (0.5325)	0.78550** (2.730)	0.39616** (2.662)	-1.5479 (-0.4749)
Pepper	0.2769 (1.196)	0.49785* (3.582)	0.62799* (3.906)	-3.6299 (-1.007)
Sorghum	-0.4120* (-71.38)	0.15304 (0.1038)	0.14014 (0.1444)	2.0861 (1.450)
Tomato	0.33199* (1.610)	0.14560* (4.447)	0.70559* (4.208)	-10.433 (-1.472)
Vegetable	0.19374 (1.059)	0.2285 (0.8280)	0.1850 (0.7591)	-5.0972 (-0.8158)
Yam	0.27603* (0.5119)	-0.94700 (-0.8529)	-0.30241* (-4.111)	15.73 (0.8139)

***indicates significant at 5% while ** indicates significant at 10% level. In bracket are t-value**

3.1 YIELD VARIABILITY OVER TIME

Table 2 indicates the way crop yield variability responds to changes in temperature and rainfall. In these cases increases in rainfall also increases yield variability for cocoyam, melon and tomatoes but decreases for yam, vegetables and pepper simultaneously, higher temperatures increase the variance of yam yields, but decrease variability for cocoyam, cowpea melon, Okro and pepper. Such results are not surprising if one looks at the characteristics of the physical locations of these crops coupled with common crop cultural conditions. Vegetable are grown best in more temperate zones and has high water requirements. Sorghum is generally grown in higher temperature and lower rainfall conditions, and the results show lower temperatures or more rainfall increase variability. A fact is not inconsistent with the finding that variability increases as temperature and rainfall are reduced.

The sign on rainfall is positive for all crops and is negative on temperature. This indicates that crop yields increase with more rainfall and decrease with higher temperatures, holding acreage constant and after controlling for a deterministic time trend that may serve as a proxy for the non-stochastic portion of the advance of agricultural technology.

Higher temperatures positively affect sorghum yields (Cobb-Douglas estimate insignificant). The coefficients on the deterministic time trend are positive and significant as expected for all crops, except the Cobb-Douglas estimates for sorghum and cassava. This may come from the tendency of Cobb-Douglas functional forms to pick up curvature because they are nonlinear over a wide range of parameter values, and may indicate a declining rate of increase in the effect of technology on yield rather than an actual negative impact of technology._

The coefficients for rainfall and temperature can be converted to elasticity by multiplying by sample average climate and dividing by average yield. Elasticity for the other crops are mixed, with uniformly high elasticity being measured for both rainfall and temperature on sorghum.

Table 2: Estimated Parameter for average crop yield production (f(X,) under linear function

Crop	Temperature	Rainfall	Year	Constant
Cassava	-0.7102* (-0.1674)	0.40433 (0.5225)	0.34459 (-1.043)	9.8511 (0.7120)
Cocoyam	0.33951 (1.578)	0.8122* (3.242)	0.13226* (3.250)	-9.4102 (-1.310)

Cowpea	-0.2760 (-1.040)	0.1909* (2.312)	0.1962* (4.053)	1.1226 (7.169)
Maize	0.13529 (1.256)	0.32788* (4.265)	0.12455** (1.840)	-3.2360 (-0.9340)
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Tomato	0.33199* (1.610)	0.14560* (4.447)	0.70559* (4.208)	-10.433 (-1.472)
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Yam	0.27603* (0.5119)	-0.94700 (-0.8529)	-0.30241* (-4.111)	15.73 (0.8139)

***indicates significant at 5% while ** indicates significant at 10% level. In bracket are t-value**

3.2 REGRESSION OF PRODUCTION PRACTISES FOR INSURED AND UNINSURED FARMERS

When considering the result table 3, it is observed that for the insured farmers, value of assets owned by the farmer and the labor employed on the farm was significant. It is also observed that output obtained by the farmer is directly influenced by the input exerted. Likewise, the value of fertilizer also has a significant impact on crop production among the insured farmer. All other variable included has a significant influence on crop production by an insured farmer except the use of agro chemical, value of seed and expenditure incurred on adaptation techniques adopted.

Some of the included explanatory variable like value of expenditure incurred on adaptation technique, the value of seeds, fertilizer, and value of labor use were significant for the uninsured farmer. This implies that they exert a great impact or influence on the level of production achieved by the uninsured famer.

The pooled result shows that the value of seed used for planting, labor, the value of expenditure on adaptation technique, use of fertilizer and the holding of insurance policy were significant. The result shows that they contribute positively to the output of farmer but at a different rate. It is also observed that agrochemical used is not found to be significant in any of the result specified.

The R^2 indicated the proportion of the variation in output of both insure and uninsured farmers. An R2 value of 93.52% was obtained for the specify function of the insured farmer as compare to 84.38% of the uninsured farmer and 90.66% R^2 was obtained for the pooled result of the two groups of farmers. The adjusted R^2 value was obtained allow us to compare the R^2 value of the different result obtained from each group of farmers. We can generate the efficiency of the result used among the farmers group from the pooled result. As we know that the higher the efficiency the more efficient the farmer is. This study use the sign of the parameter estimate of the dummy variable in the pooled result to measure the efficiency of resources used between the farmers group. The sign of the dummy reveal a positive sign coefficient which indicates that the efficiency moves toward the insured farmer which has the largest integer of coded variables, were a negative coefficient measure tends towards the uninsured farmer. The negative sign of the coefficient in this result shows that uninsured farmers were more efficient in resource use than the insured farmers. But it is noted that insurance policy have no significant relationship between insured farmer and the crop output obtained. Therefore insurance decision does not guarantee higher output level of crop productivity.

Surprisingly, apart from the fact that insured farmers embraced modern Farming practices, possibly because of their accessibility to farm credit, their farm Output does not make them better farmers than the uninsured farmers. The operation of agricultural insurance should not be limited to climatic variability but the government should complement their operations by making farm inputs readily accessible to farmers and that farmers are enlightened about their use. There are times when many of the Farm input are scarce and difficult to obtain in the open market. As a result of these problems, it may be difficult for an average peasant farmer to safeguard the correct use of these inputs that are time and quality specific for best performance

The impact of insurance is worthy to be noted here because this study reveals that it does not contribute substantially to farm output. Even among the insured farmers that used more of input, it actually contributed negatively to farm output. The two groups of farmers sampled for this study operate in a similar and contiguous area and they displayed some striking differences in their farm operations. The insured farmers are more commercially oriented in the choice of their enterprise combinations and in the inputs they used on the farm. They used more modern farm inputs and choose enterprises that are more market oriented than the uninsured farmers. However, the uninsured farmers are found to be more productive and efficient in the use of their farm inputs.

The majority of the Oyo state farmers are illiterate and with large scale poverty they have little knowledge about an insurance markets. It is on the basis of this understanding that farmers are encouraged to patronize agricultural insurance and with the assurance that it will increase their accessibility to a range of farm inputs and a further help to share the burden of risks so that they would still meet their basic obligations.

Table 3: Crop insurance payout estimation

Year	Cassava	Yam	Maize	Sorghum	Cowpea	cocoyam	Melon	Okro	Pepper	Tomato	Vegetable
1990	39900	56000	720	1425	2040	10200	1260	225	2600	2900	4425
1991	63000	201600	1200	300	3960	3660	1540	4050	8450	4750	2075
1992	40950	152800	1040	1275	1680	720	2800	2160	1820	3950	925
1993	1400	222400	1840	1950	2880	3840	140	810	4225	2150	475
1994	101850	172000	1840	1425	2520	8160	2940	6075	715	15800	1525
1995	57400	104800	720	1875	4560	1080	9660	3960	1365	10350	750
1996	30100	0	1280	3375	3240	8400	10080	315	4225	1550	2550
1997	78400	103600	720	75	2040	11460	140	1800	2470	3150	3100
1998	37100	55200	1600	75	1320	10920	3360	1260	1170	450	250
1999	81200	36000	1520	750	480	3420	560	810	325	1250	1200
2000	65450	114400	480	1275	360	1200	840	360	1105	1550	2150
2001	14350	11600	640	150	240	4020	140	315	975	150	4925
2002	66500	65200	720	150	240	3660	840	1260	260	3750	550
2003	14000	6000	80	225	1680	2580	840	630	325	250	1050
2004	50400	58000	3280	1575	720	25980	840	2970	1105	4000	725
2005	1400	35200	2080	5700	600	240	3360	2125	390	4500	1525
2006	9450	90000	3200	8775	1320	18060	840	4950	6110	9200	3025
2007	27650	187600	3680	300	960	10800	1960	1215	5005	900	1975
2008	11900	193200	2080	4800	1800	11280	13580	1890	3770	2400	1800
2009	12250	35600	17200	2175	2040	1020	10500	1170	5265	3000	2100
2010	302400	410400	22080	0	7320	19320	9240	3825	15015	12550	4350

4. SUMMARY AND CONCLUSION

The evaluation of the estimated results over climate change projections reveals how climate change has influence yield variability. This study has developed quantitative estimates of the effects of annual average climate condition on crop yield production. The results shows changes in average climate conditions which causes alterations in crop yield levels and variability which need urgent attentions in the study area.

NAIC has neither made farmers better managers and organizers of available resources for increased productivity nor able to assist farmers to adapt to the effect of climate change. Despite the fact that more insured farmers adopted improved production practices, the level of production achieved did not justify any difference of production practices between them and the uninsured farmers. This implies that uninsured farmers are more productive than the insured farmers in the study area and the level of production achieved did not justify any difference of production practices between the insured and the uninsured farmers without evidence of significant changes in the insurance payout method embrace by the insurance company since the obvious incidence of climate change

The results are found to be different by crops. For examples like maize, vegetables, tomatoes, melon and pepper, high temperature are found to have positive effects on yield levels and variability. More rainfall causes more yields to these crops while decreasing yield variance. As a results of yield variability due to loss through climate change an analysis of crop insurance to mitigate the risk suggest that the insured farmers suppose to generate more output greater net profit by the assistance of an insurance cover to reduce risk. It is observed that most of the insured farmers do not took an insurance cover to bear losses but as a pre-requisite to obtain financial assistance from a financial institution and in clear sense, most of the farmers did not have a direct access to their insurer. There has not been any evidence of adequate and prompt payment of insurance payout of any crop yield loss incurred by the insured farmers in the study area.

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